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DJ Hero Peripheral Design Document

V0.9
22/07/08

Overview

This document gives a detailed explanation of the current DJ Hero peripheral and the design thinking behind decisions made so far. It also explains the areas which we want to change or experiment with in the future.

The peripheral has been designed to look as close to an authentic piece of DJ equipment as possible within the bounds of the games requirements whilst still being accessible to those who have no real knowledge of what a DJ really does whilst performing.

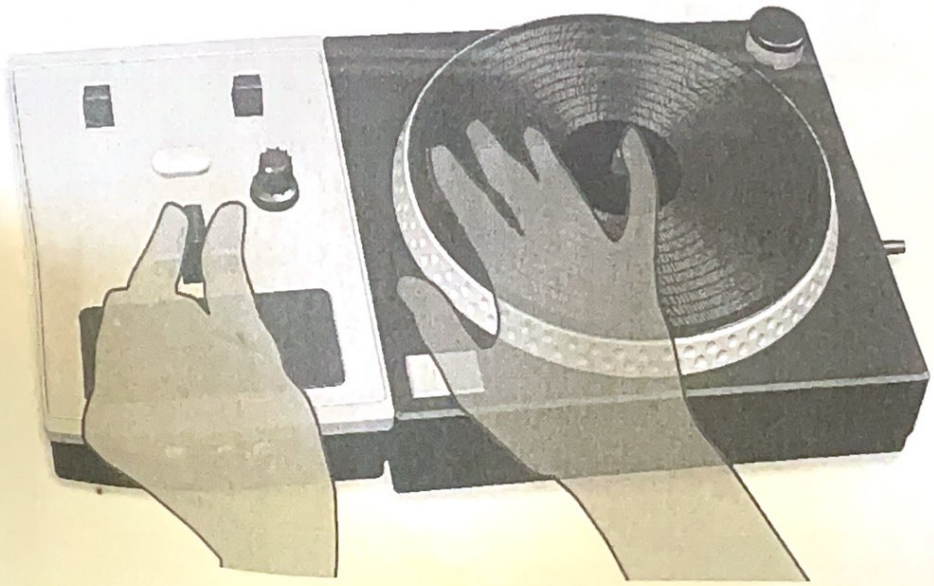
<add stuff about it being modeled on a 1210>

<add stuff about how we want to try a Pioneer CDJ styling test>

<add comment about not using licensed branding wrt: comments from Charles >

The current peripheral is a combination of 2 distinct parts each of which contain input devices and aesthetic touches to replicate an authentic DJ set-up.

This document is written from the point of view of a right handed player, where they use their left hand on the mixer and their right hand on the deck.



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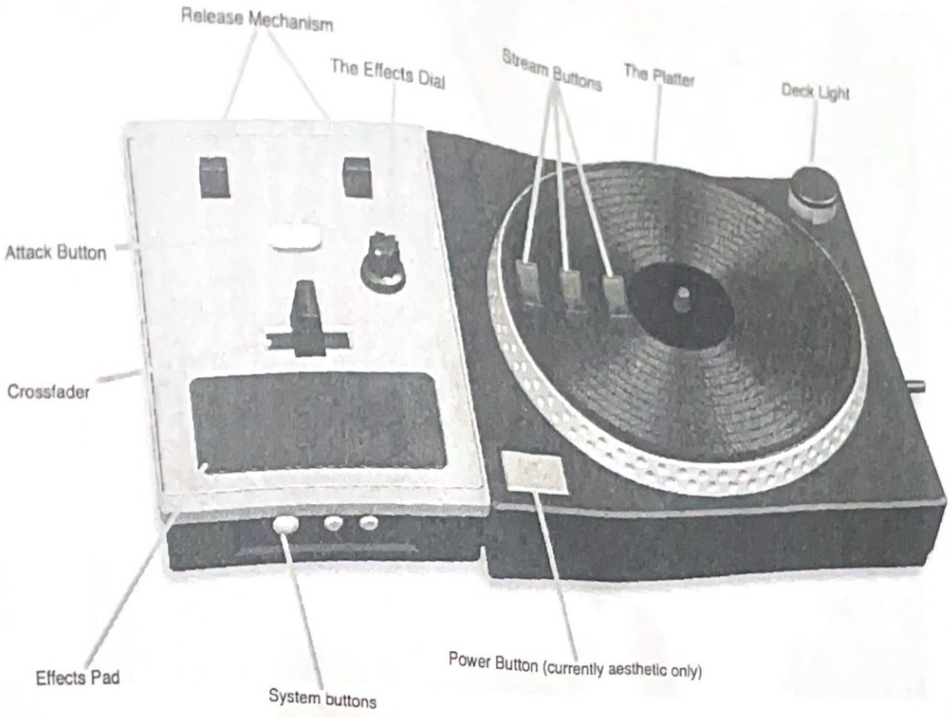

Deck

The deck section contains:

- The Platter
- Stream Buttons
- Deck Light
- Power Button (currently aesthetic only)

Mixer

The mixer section contains:

- The Cross Fader
- The Effects Dial
- The Attack Button
- The mixer release mechanism (no game-play function)
- The Effects pad (currently aesthetic only)
- The System buttons

Currently the mixer section has an insert which can be removed and inverted for left handed players (by using the slider release mechanism). In the final hardware its envisioned that the whole mixer section will be a modular part of the peripheral which could be placed on either side of the Deck section. We will have a connector on each side of the deck and each side of the mixer parts to allow this, possibly the GH4 guitar-neck connector.

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The effects pad region has no functionality at the moment - we intend to test a touch sensitive interface that would give the player a more tactile control over Audio effects and add an element of future proofing to the peripheral - this element could be used for additional elements in future iterations of the game. We want to experiment with the touch sensitive material used on the GH4 guitar. We could have 5-6 vertical strips of the material, giving us effectively vertically slide-able "piano keys".

We are currently building a number of different mixer sections with alternative control placement so we can properly test the ergonomics of this section. The next mixer layout that will be manufactured has the Effects Dial and Attack button symmetrically placed opposite each other, above each side of the cross fader.

The peripheral is designed to be played either resting on the players lap or a coffee table. There are sticky pad strips on the bottom of it to prevent it from sliding around when the player is performing scratching and high force actions

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Cross Fader

The cross fader is used by the player to select which audio track(s) are heard (and which are not). They do this by sliding the fader to the left, right or leaving it in the default central position which means both audio streams are heard.

The player must hold the cross fader in position - it will auto return to the central position if the player releases it.

The cross fader acts as the "home" position for the players left hand as its the most common input used on the mixer section.

Current Hardware

- The Cross fader is a sliding mechanism with 3 logic states.
  - Central (default)
  - Left
  - Right

- The cross fader must be held in the left or right positions – it will not stay there.
- When the player releases the cross fade it currently returns to the default central position.
- The cross fade mechanism has 2 micro-switches to give positional feedback to the game. When both switches are "on" the cross-fade is central. As the player moves in one direction the opposing switch will almost immediately release. This gives the cross-fader a quick response that is essential to the game whilst still allowing the cross-fader to move and feel like a real life crossfader.

Earlier Versions

- An earlier version of the sliding cross fader had the micro switches at the end of the travel - this didn't work too well as the player did not get an immediate response to the movement of the crossfader. In the game the player has to make rapid cross fader movements so that is how we ended up with current design.
- Another previous design of the crossfader had it as a rocker mechanism rather than a slider. This worked well but is not as "realistic" as a sliding one which is why we changed it over.

<insert picture of rocker crossfader>

Future Versions

- We intend to experiment with a non self-centring mechanism in the future. So it remains in the position the player last moved it to. This will require a détente for the default central position to allow the player to easily "find" the middle. This part may output an analog signal that we then in game code interpret as being in one of the 3 positions (possibly user configurable).

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Effects Dial

During the game the player can overlay live Audio effects over the mix in certain marked regions. They do this by rotating the dial clockwise or anticlockwise. The audio effect is directly proportional to the amount of rotation the player applies. An on-screen DSP meter will give feedback to the player showing how much effect they can apply in either direction, any stream that has been affected will have a visual distortion that's directly linked to the players input. (like a sine wave on an oscilloscope).

<insert picture of hand on the Dial>

<insert picture of in-game DSP use>

The actual audio effects used will be dependant on software and be custom fitted to each track, some tracks may use a phase effect others a stutter or Flange.

Current Hardware

- The Dial infinitely rotates - it has no limits or constraints and no detent
- The dial outputs exact positional data (8 bit <need to check this>)
- The dial is situated on the peripheral so it can be used with either the left or right hand.
- Even though the dial rotation is unlimited, the audio effect has to be capped to prevent it sounding unpleasant so an on screen meter shows that the limit has been reached and that continuing rotating will not increase the effect.
- When the player enters an Effects region the position of the dial will be read as the "middle" (or zero) - the player can rotate left or right to add more of less of the "zero" effect. i.e. the software reads the current positional state of the dial at the start of every Effects section and uses that as the "zero" value.

Earlier Versions

- Detented - we had a detented dial but this didn't prove popular as it offered more resistance to the player to move the dial and the detent had no purpose or meaning
- Lock to lock - we had a version where the dial could only be moved from a lock to lock (i.e. not freely rotating). This gave us a problem if the player left the dial over on one lock during game-play and then a new effects section came along - they could not move the dial in one direction and the effect would have to be immediately on "full"
- Larger knob - we had a much larger knob on the dial, but this was not as ergonomic as the current knob
- Smaller knob - we had a much smaller knob on the dial, again this was not as ergonomic as the current knob.

Future Versions

- We have no plans to change the Dial, however if the Effects pad (see later) proves to work it then raises the question of whether we need the Dial. It is very authentic and for that reason alone it is worth leaving it on the mixer regardless of the Effects pad.

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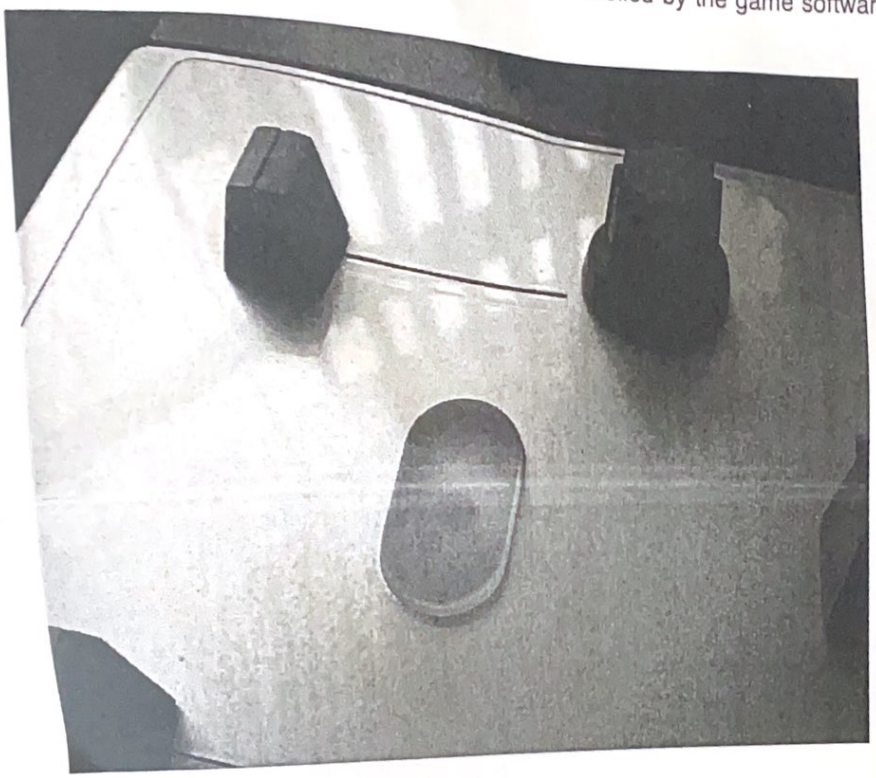
The Attack button

During the game the player will earn power-up and weapons, these can be triggered by hitting the attack button at any time.

Current Hardware

- The attack button sits above the Cross-fade so it is easy to hit with with the left hand whilst still cross-fading and scratching, this is essential as the player needs to trigger at any point in a mix - without looking down at the deck.
- The attack button is large and has an arcade button feel as it needs to feel satisfying and robust to hit quickly.
- The attack button is made of semitransparent plastic - a blue LED lights up if a power-up or attack is available to use. This is controlled by the game software via the rumble interface.



Earlier Versions

- Initially the attack button lived underneath the Effects dial. This worked by pushing down the dial to trigger the button. We dismissed this idea as it was not at all obvious to the player that the dial could be pushed down and it broke the generally good rule of - one control, one function.
- Another version had an almost flush button to the mixer, which made it harder for the player to press, so we revised it to be more raised up
- A prototype version used an actual arcade (Jamma) button which gave us the feel we liked and we tried to carry across to the current button design, with a little bit

less travel than an actual arcade button.

Future Versions

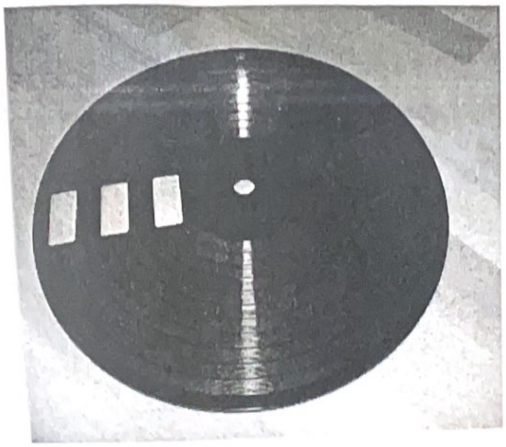
- We have no plans to massively change the button, other than to try alternative positions on the mixer to find the best ergonomic placement.

The Platter

The platter is the "home" position for the right hand and in conjunction with the platter buttons is the main input device. The platter pivots around the centre to moving like a real deck.

Current Hardware

- We currently have 2 variations of the way the platter works. The 2 variations both have pro's and cons. We are working on a 3rd variation (see below) which combines some of the benefits into a single variation. We believe that the only way to resolve the final hardware design will be put play test the variations internally with novice and expert players and make a decision based on feedback.
- We now use electronics which gives us an absolute position for the platter from 0-255 values, this equates to 1.4 degrees per integer.
- The positional information is gathered via a potentiometer mounted in the middle of the platter that it sits on as it rotates.
- The edge of the platter has a pattern to it. Currently this is a recessed dimple pattern. Initially this was intended as just a styling element but it has become clear that some players use it as a rest for the thumb and a grip to assist them with the scratching actions. It also promotes a comfortable hand position for long play sessions. We have now painted the deck edge in a rubberised paint to assist the players "thumb grip" as our initial glossy finish was too slippy.
- Finally, there is a vinyl face plate attachment that sits on top of the platter (there are holes for the buttons to protrude through). This is intended to be just like the guitar face plates - a swappable part for the players to collect, buy, swap, etc.



Earlier Versions

- Earlier versions of the platter only gave us velocity values which was deemed not enough information in order to be able to properly determine the players actions for the game.

Future Versions

- We are working on a hybrid version of the 2 variations mentioned above. This will allow the players to freely rotate the deck but still have a sprung, auto-centring mechanism that moves around with the button orientation. This will work such that when the player is making small up forwards and back movements they get the spring assistance, but if they decide to fully rotate the platter then they push this spring mechanism around, once they stop rotating the platter, the spring mechanism is "active" again.
- We are investigating an alternative rotation pick-up system that uses a slotted optical pickup sensor and a moulded tooth pattern (around the inner edge) together with some electronic hardware to read this at a higher rate than the game software (which is 60fps) and then provides positional information to the game software. **Note: this solution is used in the Konami beatmani peripheral**. The purpose of this is to try and minimise friction and make a more robust solution (we have had several potentiometer failures).
- We are creating a version of the platter with raised dimples (as opposed to recessed) to see if this improves the thumb grip more. Additionally we are considering whether we should colour, highlight or even mould in a recess for the "thumb zone" - the area in which players should / could be placing their thumb to assist in game-play actions (see pictures in next section)

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The Platter (Stream) Buttons

On the top of the platter are 3 identical buttons arranged and spaced such that they comfortably rest under the players right hand. The index finger sits on the outer button and the ring finger on the innermost one. The buttons are the primary game play functions for the the players right hand. Each button controls inputs on the correlating on screen display. Buttons are used to trigger gem hits on each stream and to perform scratches by holding them in conjunction with platter movement forwards and backwards.

Currently the game only allows scratch actions to be performed on the two outer most buttons because of the physical exertion required to scratch (rotate) the platter with the ring finger on the inner button. We hope in future revisions that we can allow scratching on all 3 buttons and that the friction and exertion required for the inner button is overcome.

Current Hardware

- We use 3 micro switches <check this> that sit under our button moulds. The current button moulds are rectangular, have a raised lip edge, sit above the platter and have a dished profile.
- The buttons transmit the registered buttons presses via an IR sender that sits in the top of the platter (powered by 2x AAA batteries also housed in the platter) and there is a circular arrangement of 12 IR receivers in the bottom of the platter base. This allows us to have a free rotating platter with no wires to tangle up.

<insert picture of IR receivers, batteries, IR sender>

- There are a number of issues with these current buttons that we aim to resolve in future versions (see below), these are:

1. The edges of the dished buttons feel uncomfortable under the finger.
2. some players thought the buttons were rocker buttons (i.e. have two switches - front and back) because of the shape of them
3. the length of the buttons cause the button mould to pivot over the top of the contact patch with the micro switch resulting in an infrequent miss of the button press, when the player feels like they have properly registered a button press.
4. The buttons have corners which are not very ergonomic as the player scratches the orientation of the button rotates wrt the players finger so that the end of the finger is pushing up against the corner of the button

<insert picture of this issue>

Earlier Versions

- Previous versions had much wider, squarer buttons and whilst these worked well as buttons, they exhibit the "can't scratch using inner button" issue.

Future Versions

- We have a revised platter button design which we hope will resolve all of the issues highlighted above. The buttons are rounded, the middle button is pronounced forwards (and backwards), they have a smaller dish profile and they are positioned further towards the outer edge of the platter. The pictures below show the new design.
- We want to try using the touch sensitive material from the GH4 guitars for these buttons. The hope is these will sit really nicely on the platter surface and be less

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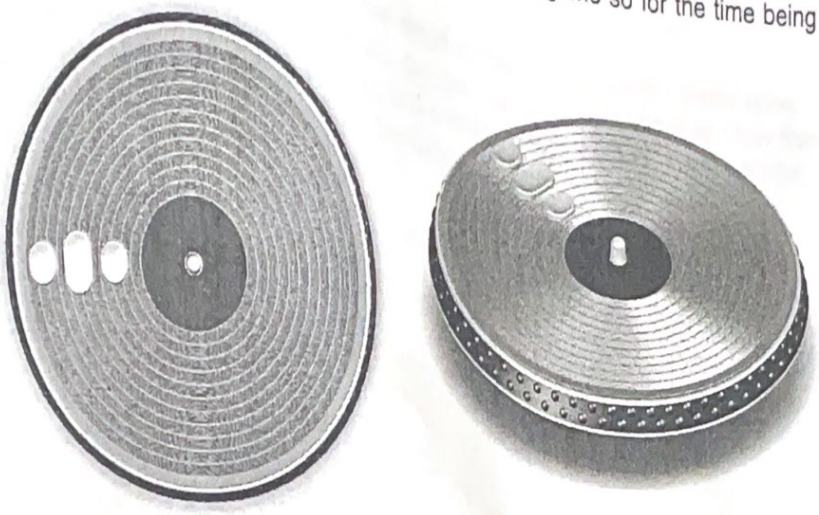
visually intrusive.

- We intend to colour the buttons to match the colours of the in-game streams. Currently we are reviewing the colours used in the game so for the time being the buttons remain plain.



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The Platter Light

Current Hardware

There is a red LED light mounted into the small raised cylinder on the platter base. This can be controlled by the game software, but we currently only use it to show that the controller is correctly set-up and working and therefore it is generally on all the time. It is mainly for styling and authenticity as DJ decks tend to have a light like this.

Future Versions

We will need to have controller ID light(s) just like the guitars (and all other controllers) to indicate whether the controller is number 1, 2, 3 or 4. We may also need to incorporate a d-pad controller into the unit (like the GH4 guitars). Note: that this would require us to then have unique platform deck components as well as mixer components if it remained in its current position.

The System Buttons

On the front edge of the mixer section are the 3 system specific buttons Start, Select and Home (or the equivalent of, on XBox360).

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Final Hardware Further Plans / Thoughts

Wired Vs. Wireless

All versions of the peripherals up till now have been wired. This is because we have piggy backed a real X360 controller in order to be able to use them with the game software. It is likely that the consumers will expect the final controllers to be wireless and therefore the additional components and electronics required will need to be planned into the design. There will likely be a PS2 version of the game and it needs to be considered if this will be wireless or wired (or both).

Platform Specific Mixer / Cross Platform Deck

We propose that we should consider making the mixer unit the "brains" of the peripheral and this is different per platform (or there are panels that swap per platform) but that the deck unit is cross platform compatible. It contains no platform specific elements.

2 Decks, One Mixer

We want to leave the option open for future versions of the software to support 2 decks plugged into a single mixer unit via the 2 connectors on each side of the mixer. This is likely to require planning in advance so that the electronics can handle it and it doesn't crash the game software on current titles.

Wii Peripheral

We have one Wii peripheral at present that piggy backs a Gamecube controller. We envisage that the final hardware will incorporate a slot for the Wii-mote to slot into the mixer unit, with the Wii-mote buttons facing out where the current system buttons do. The width of the mixer unit was designed with this in mind.

Headphone Jack

We have always intended the peripheral to support a headphone jack. Not only is this more authentic to a real DJ but it would also be very cool for the player to be able to play the game with headphones on and not disturb others. However, we are not sure what the technical challenges this raises for both a wired and a wireless controller.

Midi Support

It has been suggested that Midi support could be useful for the peripheral for future compatibility with other instruments in the Hero range. The benefits need to be evaluated and considered against the additional complexity and costs.

Stand

It might be possible to also supply a stand for the peripheral like the Drums. However, we are not sure a stand will have sufficient strength against the scratching motion the players perform and as such this needs to be evaluated.

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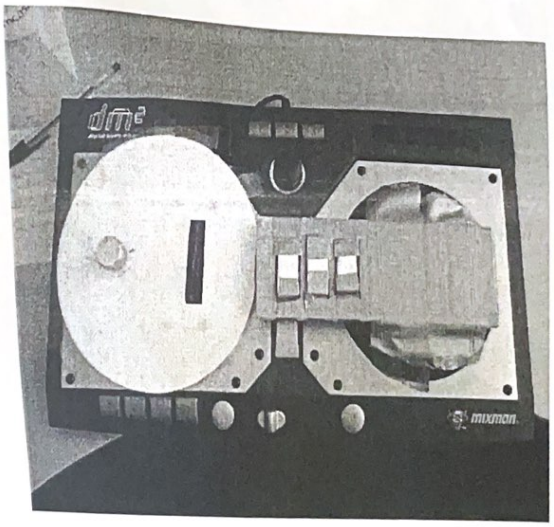
The Evolution of the Peripheral

Phase 1 - Mock-up

Phase 2 - *Working hack*



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Phase 3 - Custom plastic

Phase 4 - Re-designed plastic, Custom electronics